ENVIRONMENTAL VALUATION AS A SUPPORTING TOOL FOR ENVIRONMENTAL SERVICES PAYMENTS

PREPARED BY THE OAS
DEPARTMENT OF SUSTAINABLE DEVELOPMENT
FOR THE OAS-IICA EXPERTS' WORKSHOP ON SUSTAINABLE AGRICULTURE FORESTRY AND TOURISM
November 2nd, 2005
San Jose, Costa Rica

Introduction. For thirty years, work has progressed in linking environmental and conservation policies and projects with economics. The motivation behind environmental economics and its founders such as David Pearce – who passed away suddenly in 2005 – is simple. Environmental degradation is caused by the under-pricing or non-pricing of different kinds of environmental services. Since those services fall outside of monetary value and markets, environmental valuation estimates the monetary value of different environmental services that, if priced, could be exchanged within markets*, if such markets existed*. The goal of environmental valuation – which finds its roots in cost-benefit analysis (CBA) – is to impute a market value for environmental-related services and amenities.

Although some ecologists object to assigning a monetary value to ecological services as representing a kind of "commodification" of the environment, environmental economics has no pretense of valuing all ecological functions. Instead, its objective is to impute one kind of value by measuring public preferences, in the same way other kinds of demand curves are imputed (Georgiou et al, 1997). From a policy stand-point, since environmental services are either severely under-priced or elude price formation altogether, such services are regarded as free or as public goods which in turn carry little weight among economic decision-makers and the public.

Estimating Environmental Values. Several commentators (Bishop, 1999) have noted that environmental valuation both builds upon and extends the kind of trade-offs that exist in CBA tools. Probably the most significant is widening the scope of CBA analysis from estimating the costs of different kinds of damages versus derived benefits, to attempting to value indirect and intangible non-market values related to biological diversity. One of the reasons this widening of the focus of valuation to try and capture the indirect benefits of biological diversity – broadly defined – is because of the lack of complete understanding in the scientific community of different biodiversity functions, as well as the incomplete understanding of the relationship or linkages between different natural system functions.

There are numerous approaches used in environmental valuation studies. These include measuring the direct costs of environmental services in explicit markets (such as the revenue from selling a ton of carbon); the productivity method (such as measuring the contribution that pollination makes to total farm-gate output); hedonic pricing estimates (using for instance changes in real estate or other market process as a proxy for the value of the environmental services derived from the environmental service); the travel cost method (which measures how much people will spend to visit protected parks such as in Costa Rica); contingent valuation (including – as noted above – undertaking different kinds of willingness-to-pay surveys or questionnaires); and damage cost avoided methods (measuring how much people would spend to avoid environmental damages); and benefits transfers (discussed below).

This note does not attempt to examine the different strengths and weaknesses that have been identified with different approaches (see for example, Dixon and Sherman, 2000).

However, the main goal of these approaches is to measure the Total Economic Value (TEV) of environmental services; defined by the following components:

TEV = Direct Use Value (DUV) + Indirect Use Value (IUV) + Option Value + Existence Value

These components are described below:

- Direct Use Values: direct benefits that arise from the use/extraction of an environmental service. In the case of tropical forests, this would include the revenue derived from selling logs illegally or legally, the use of residue for fuel or building purposes, and the direct genetic benefits that can be extracted and sold to genetic-resource buyers.
- Indirect Use Values: the indirect benefits of different kinds of ecological functions, taken in isolation or jointly, but are rarely exchanged in the market. To use forestry again as an example, these include the contribution of tropical forests to top-soil quality, species habitats such as wetlands and tree canopies, and the storage of carbon.
- Option and Existence Values: involves measuring an individual's willingness-to-pay to converse the option of making use of a tropical forest or biological resource in the future, even if the current value of that resource is unknown, undervalued or imperfectly understood. Related to this is the notion of existence value, whereby an individual expresses willingness-to-pay for an environmental service, even if no plans are presented to "use" the components of the forest now or in the future.

The main assumption of environmental economics is that, for most activities, direct use values are less than the combined values of indirect value uses and option and existence values. The question is whether this assumption has affected policy choices or behavioral choices.

Currently, there are hundreds of studies which point to different values of environmental services.
For example, studies for the past decade have shown that the indirect use values and other values derived from the sustainable use of tropical forests is greater than the direct use values (revenues) to loggers derived from clearing forests, as well as benefits of cleared lands for cattle-ranchers and growers of soybeans and other produce.

However, making use of the case that TEV is greater than DUV has largely failed to influence on-the-ground activities. To name one case, in 2004, rates of deforestation in tropical countries – fueled in large part by illegal logging – in such countries as Brazil, Honduras, Guatemala, St. Lucia, Haiti and other countries has increased.[1]

The Question of Linkages: Does it Matter?
One obstacle is the extent of imperfect knowledge about the current value of biological diversity, as well as the future value of services like biological diversity, carbon storage, genetic uses, or the value of natural habitats for human health protection.

One way of approaching this question of linkages and their role in establishing effective ecosystem service payment systems is by defining what is differentiating between environmental services and environmental functions. A recent report by Resources for the Future (RFF) provides the following highly useful distinction:

> Ecosystem services are the end products of nature that yield human wellbeing. Three necessary conditions define an ecosystem service. First, and most obvious, the service has to emerge from the natural environment. Second, a service must enhance human well-being. Third, a service is an end product of nature directly used by people…*ecosystem services are not the same thing as ecosystem functions*. Functions are the biological, chemical, and physical interactions associated with ecosystems. These functions are the things described by biology, atmospheric science, hydrology, and so on. Services depend on these functions but are different: they are the aspects of the ecosystem valued by people.[2] (emphasis added)

Part of that imperfect knowledge relates to a lack of understanding of different linkages between environmental services. For example, the International Plant Genetic Resources Institute (IPGRI) has concluded that valuing crop genetic resources from *in situ* crops remains "exceedingly difficult" because those resources have multiple uses and various indirect functions. One narrow way of estimating the value of biological resources is by estimating the value of germplasm from land races to track the demand of plant breeders for current and intended future use. However, IPGRI notes that there are data-gaps, especially among smaller germplasm banks, about requests for uses by plant breeders.[3]

A second example of imperfect knowledge is related to the widely assumed concept that deforestation increases the vulnerability of communities due to flooding and related natural disasters. A recent joint report by the UN Food and Agriculture Organization (FAO) and the Center for International Forestry Research (CIFOR) entitled "Forests and Floods: Drowning in Fiction or Thriving on Facts?" concluded that despite an assumed link between deforestation and downstream flooding, there is no evidence that shows that a loss of trees significantly contributes to severe widespread flooding.[4]

These two examples underscore the main challenge related to valuing ecosystem services, identifying the links that exist between the different structures and functions of natural systems, and the weighting of those different systems in terms of their contribution to derived benefits. Ecosystems are obviously highly complex, while – as noted – the absence of markets for most environmental services derived from ecosystem functions are at best, ill-defined. A recent report from the U.S. National Academy of Sciences concludes that:

> Probably the greatest challenge for successful valuation of ecosystem services is to *integrate studies of the ecological production function with studies of the economic valuation function.* To do this, the definitions of ecosystem goods and services must match across studies.[5] (emphasis added)

The committee that prepared the U.S. National Academy of Sciences report concludes:

- *Policymakers should use economic valuation as a means of evaluating the trade-offs involved in environmental policy choices; that is, an assessment of benefits and costs should be part of the information set available to policymakers in choosing among alternatives.*
- *If the benefits and costs of a policy are evaluated, the benefits and costs associated with changes in ecosystem services should be included along with other impacts to ensure that ecosystem effects are adequately considered in policy evaluation.*
- *Economic valuation of changes in ecosystem services should be based on the comprehensive definition embodied in the TEV framework; both use and nonuse values should be included.*
- *The valuation exercise should be framed properly. In particular, it should value the* changes *in ecosystem good or services attributable to a policy change.*
- *In the aggregation of benefits and/or costs over time, the consumption discount rate, reflecting changes in scarcity over time, should be used instead of the utility discount rate.*

Despite the tremendous ongoing progress, there are various challenges that exist with valuation studies. First, most valuation studies take place at the local level, and use some kind of willingness to pay (WTP) questionnaire to measure local preferences. Due to differences in methodology, there is a basic problem in comparing the results of different surveys, as well as scaling-up findings in order to arrive at some kind of aggregate overview. One study by Constanza et al. (1997) attempted to arrive at some kind of consolidated figure that measures the total annual value of the world's combined ecosystem functions. The study established that value at US$36 trillion. The estimate sparked a useful technical debate about differences in methodologies, the availability and comparability of data, as well as a welcome policy debate about the purposes and application of valuation studies.

Second, most valuation studies are not intended to facilitate actual market transactions, but instead they intend to help inform decision-makers of the consequences of their decisions. The use of CBA is particularly useful in framing the economic implications of new regulations to control pollution. To illustrate, when the European Commission announced in September 2005 their proposed clean-air strategy would cost €7.1 billion (US$8.6 billion) per annum, it noted that that the direct health benefits derived from the implementation of the strategy would exceed €42 billion (US$51 billion).[6]

This information helps inform policy makers of the different trade-offs of their decisions, but it does not directly help in creating prices for clean air versus dirty air, not market-based incentives within which clean air may be traded.

Third, WTP and other kinds of valuation activities are often time-consuming and expensive.
It is the third area – namely the cost and time needed to undertake a full valuation study at the local level – which has increased interest in benefit transfer systems. The benefit transfer method is used to estimate economic values for ecosystem services by transferring available information from studies already completed in another location and/or context.

Questions for Workshop Participants.

- The key question is whether an environmental valuation study is a prerequisite in order to establish an environmental services payment system?
- If so, then how do such systems approach the issue of imprecise linkages between different ecosystem functions? For example, does imperfect knowledge of upstream water-basin functions hamper the ability to design downstream payment transfer systems? Does it matter?
- If a major objective of the OAS ministerial process is to scale-up successful sustainable forestry and agricultural practices, then what kind of information transfer and regional approaches to valuation and ecosystem payment systems could be identified and supported at the hemispheric level? For example, does the current system of international or transboundary basin management systems create a potential focus for international ecosystem payment systems?
- Finally, how can practical knowledge derived from current valuation studies help support ecosystem payment systems?

Further Reading (in addition to references):

Bishop, J. (1999) *Valuing Forests*, Working Paper: International Institute for the Environment and Development, London.

Carson, R., (2002), *Contingent Valuation: A Comprehensive Bibliography and History*, Edward Elgar Publishers, London.

Constanza, R. et al., (1997), *The Value of the World's Ecosystem Services and Natural Capital*, Nature 387: 253-260

Dixon, John and P.B. Sherman (1990), *Economics of Protected Are*as, Island Press.

Freeman, A.M. (1993), *The Measurement of Environmental and Resource Values: Theory and methods*, Resources for the Future.

Pearce, David (2001), *How Valuable Are Tropical Forests?*, IDDRI Publications, Paris.

Pearce, David and R.K. Turner (1992), *The Use of Benefits Estimates in Environmental Decision-Making*, OECD.

World Bank (2005), *Where is the Wealth of Nations? Measuring Capital for the Twenty-First Century*.

REFERENCES:

[1] In May 2005, the government of Brazil released figures showing deforestation in the Amazon rainforest reached 10,088 square miles (26,129 square kilometers) for the year ending August 2004. Deforestation in the Amazon in 2004 was the second worst ever as rainforest was cleared for cattle ranches and soy farms.

[2] Spencer Banzhaf & James Boyd (2005), *Ecosystem Services and Government Accountability: The Need for a New Way of Judging Nature's Value*, Resources for the Future.

[3] International Plant Genetic Resources Institute (2002), *CGIAR System-wide Information Network for Genetic Resources, Linking Conservation and Use*.

[4] FAO and CIFOR, *Forests and Floods: Drowning in Fiction or Thriving on Facts?* October 13, 2005.

[5] National Academy of Sciences (2004), *Valuing Ecosystem Services: Towards Better Environmental Policy-Making*.

[6] The Commission calculated that the number of deaths caused by air pollution from ultra fine dust particles and ozone would decline, because of the

implementation of the new Clean-Air Directive, from 370,000 per year in 2000, to 230,000 in 2020. Related health benefits include fewer premature deaths, less sickness, fewer hospital admissions, improved labor productivity and other benefits, which together would exceed €42 billion (US$51 billion) per year. It is important to note that most environmental and notably, pollution regulations introduced in OECD and other countries require a cost-benefit analysis. Although the health benefits of pollution regulations are the most striking benefit, other benefits derived from air pollution regulations like that of the European Commission include a reduction in damages to forests, clean water and buildings from the effects of acid rain, or other benefits.